# APPENDIX A: Rapid Screening Methods/Rapid Sediment Characterization (RSC)

It is not always necessary to use the same analytical methods that will be used in the definitive study, as simpler methods may be adequate to estimate COPC concentrations or measurement endpoints. New rapid screening tests are continually being developed, and a check of the literature for recent developments should be conducted prior to selecting screening tests for a site. Examples of screening techniques for chemical measurements and toxicity are discussed below; most are described in greater detail in EPA (1994). Another survey of Rapid Sediment Characterization (RSC) tools is available at http://web.ead.anl.gov/ecorisk/issue/pdf/rsc.pdf.

## ***Total PAH by Fluorometry***

The total PAH assay using fluorometry is fairly rapid (20 samples/day) and inexpensive, and is strongly correlated with GC/MS and high-pressure liquid chromatography (HPLC) analyses (Friocourt et al. 1985). This method is particularly sensitive to compounds containing aromatic rings, such as PAH, but does not respond to a wide range of organic compounds found in sediment, such as aliphatic hydrocarbons from oils, fatty acid methyl esters from natural and anthropogenic sources and phthalate esters.

## ***Total PCBs, Chlorinated Pesticides, and Other Organic Chemicals by Enzyme Immunoassay***

Enzyme immunoassays are biochemical procedures that utilize the binding of specific chemicals in a sample (with an enzyme-labeled version of the chemical) to antibodies provided with a test kit. For sediments, a small sample is quickly extracted and purified. The extract is then tested with the immunoassay kit. Chemicals bound to the antibodies are then separated from the rest of the sample and associated interferences by simple washing. The labeled component is detected by adding a color indicator (Schrynemeeckers 1993). Enzyme immunoassays are inherently free of most confounding factors (Vanderlaan et al. 1991) and are available for several aromatic compounds (e.g., PCBs, pesticides, petroleum hydrocarbons, PAH, trinitrotoluene, benzene). These assays typically identify the presence or absence of chemical mixtures such as total PCBs at some predetermined concentration. Typical detection limits are usually 1-3 orders of magnitude higher than sediment specific laboratory methods; however, they are sufficient to identify problem areas that may warrant greater focus under Step 6. The detection limit for total PCBs in sediments for various test kits ranges from <0.1-5 ppm (wet weight).

Significant cost savings will be realized most readily at sites that have a limited number of contaminants of concern, where only a single immunoassay is required. Several different immunoassays would be required to fully characterize sediments containing a wide range of

compound classes of concern, because each kit is sensitive to only one of the compounds or classes of compounds described above.

### ***Total Petroleum Hydrocarbons by Infrared Spectroscopy***

The infrared assay is intended to be a field version of the extractable residue analysis of the relict USEPA Method 418.1. This analysis is useful for estimating total petroleum hydrocarbons (TPH) because it measures responses in selected narrow ranges of the infrared spectrum. A variety of hydrocarbon structures are simultaneously detected in a sample by characteristic changes in carbon-hydrogen or carbon-carbon bonds (e.g., stretching and bending vibrations). These changes are induced by exposure to infrared radiation. Detection limits are typically in the range of 1-10 ppm. The infrared method has the advantage of providing a rapid, quantitative determination of TPH concentrations, but also has some limitations that can produce either negative or positive analytical bias (Douglas and Uhler 1993). As a result, this screening method may be less accurate than other techniques for measuring hydrocarbons such as field gas chromatography or TLC, which have a higher cost.

### ***Semivolatile Organic Compounds by Thin-Layer Chromatography***

The TLC field method, developed by Friedman & Bruya, Inc. (Seattle, Washington) and reported by Newborn and Preston (1990, 1991), can be used for a wide range of semivolatile organic compounds with detection limits of approximately 10 ppm. Lower detection limits to approximately 1 ppm are feasible for some compounds. This method involves placing a drop of sample extract near the bottom of a silica gel-coated glass plate. The end of the plate is immersed in an appropriate solvent. As the solvent front moves upward on the plate, the compounds of interest are separated out of the mixture based on their mobility in the solvent-solid phase system, and can then be identified both qualitatively and quantitatively, using ultraviolet light or iodine to visualize the separated chemicals.

### ***Metals by X-ray Fluorescence***

Field portable XRF units have been used to analyze soils at Superfund sites (e.g., Fribush 1992; Driscoll et al. 1991) and have been shown to provide rapid (<5 minutes/dried sample) quantification of more than 20 elements at a time. Detection limits for portable units have typically been reported in the 100-1,000 ppm range for most metals, while laboratory-based XRF units have greater resolution and are capable of lower detection limits in the range of 2-25 ppm. Laboratory XRF units have a somewhat longer analysis time (20 minutes). XRF analyses, unlike other metal analyses that rely on digestion of samples with various acids, do not destroy the sample and require only a small amount of material. XRF has produced results that correlate

strongly with results produced using conventional atomic absorption and inductively coupled plasma (ICP) spectroscopy (Kuharic et al. 1993).

### ***Rapid Toxicity Tests***

The Microtox® test is a rapid, sensitive method of toxicity testing based on light emission by the luminescent bacterium *Photobacterium phosphoreum* in the presence and absence of aqueous toxicants. The emitted light is a product of the bacterial electron transport system and thus directly reflects the metabolic state of the cells. Accordingly, decreased luminescence following exposure to chemical contaminants provides a quantitative measure of toxicity. Two or more rapid toxicity tests may be performed in tandem to increase sensitivity and coverage, for example with Microtox ® and Mutatox ® (Johnson and Long 1998).

### ***Feasibility of Non-standard Methods***

Non-standard methods may sometimes be useful in the evaluation of sediment quality; examples are *in situ* toxicity tests, bioaccumulation studies using non-standard species, or colonization studies of artificial or natural substrates. Preliminary studies should be performed (in Step 5) for any non-standard, unverified test using a limited number of replicates to ensure that data quality objectives will be met under site conditions.